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ABSTRACT

This curriculum guide, one of 15 volumes written for field test use with educationally disadvantaged industrial education students needing additional instruction in the basic skill areas, deals with helping students develop basic mathematics skills while studying metalworking. Addressed in the individual units of the guide are the following topics: performing lattice multiplication, reading a ruler, marking lines for welding, choosing the correct size rivet, using fractions and decimals to build metal shop projects, measuring with decimals, and reading a micrometer. Each unit contains some or all of the following: a discussion of the major concepts of the technique being covered, instructions to the teacher concerning the use of the given technique, suggested related activities, student instructions, a student assignment, supplemental activities, and one or more worksheets. A basic skills checklist and a basic skills verification form are also provided to assist teachers in identifying those students who require additional help with basic skills. (MN)

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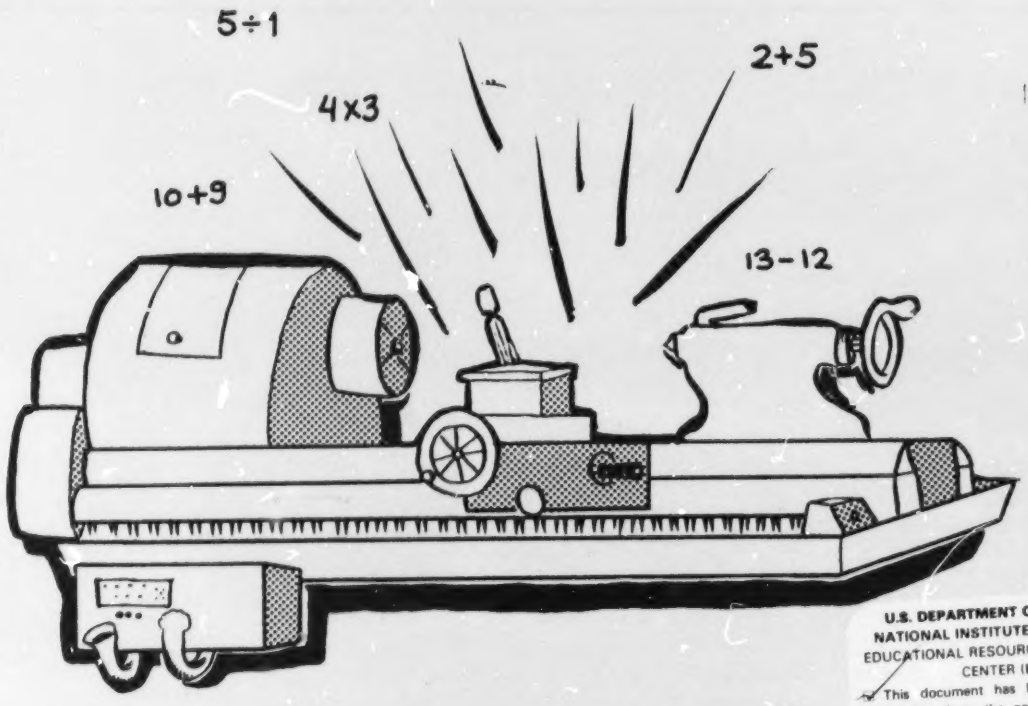
"Learning to do Math the Metalworking Way"



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INTRODUCTION

These instructional techniques were developed for those industrial education students who demonstrate a need for additional instruction in the areas of reading, writing, math, verbal and visual communication. They were written by industrial education teachers with a particular emphasis upon teaching a basic skill while retaining a major focus on the subject areas of auto, woods, metals, electronics, and drafting.

Each of these instructional techniques were written using the same format and with guidance from an expert in the areas of reading, writing, math, verbal and visual communication.

In order to help you identify those students who require additional help with the basic skills, a simple easy-to-use BASIC SKILLS CHECKLIST is provided with each subject area module. This Basic Skills Checklist will enable you as the Industrial Education Teacher to better identify those students in your classes who require additional help in the basic skills.

Additionally, a BASIC SKILLS VERIFICATION FORM is provided which will enable you to ask your school's reading resource teacher, basic skills teacher, math resource teacher, Hart Bill Conferencing teacher, or grade counselors, to verify your identification and provide you with help in the instruction of the basic skills.

You may wish to use these techniques as instruction for your entire class, or as a take-home, parent-involvement assignment. They may also be used in your school's reading or math lab or in conjunction with your school's basic skills instructional programs.

These instructional techniques are successful because your students are able to relate reading, writing, math, verbal and visual communication to their own industrial education classes. When your students succeed, they feel good about themselves, good about their schools, and good about their future.

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Name _____

CONFIDENTIAL Grade _____ Class _____

Date _____

BASIC SKILLS CHECKLIST (METALS)

The following is a list of the basic skills (reading, writing, math, verbal and visual communication) that the student should demonstrate an ability in for the purpose of employment or advanced training in the metals trade.

1.0 Verbal Communication: The student needs additional instruction in verbal communication if any of the items below are checked NO:

1.1 Yes ____ The student understands verbal directions or information given by the teacher.

No ____

Example: The teacher informs the student that safety glasses are required when using the grinder. Does the student use safety glasses when required?

1.2 Yes ____ The student asks questions about instructions or information not understood.

No ____

Example: Did the student ask questions about the operation of a particular machine if it appears that he/she does not understand the instructions given?

1.3 Yes ____ The student is able to apply information and directions heard to work situations.

No ____

Example: After receiving instructions on the proper use of a machine, is the student able to have a basic understanding of its operation?

1.4 Yes ____ The student is able to verbally communicate with the teacher and other students.

No ____

Example: Is the student able to convey instructions/information to other students?

2.0 Writing: The student needs additional instruction in writing if any of the items below are checked NO:

2.1 Yes ____ The student is able to summarize and write a customer work order.

No ____ Example: A customer requests a certain type of welding job; is the student able to convey this request in writing on the job order form?

2.2 Yes ____ The student is able to communicate in writing instructions for a job to be performed.

No ____

Example: Is the student able to convey instructions to another student about a job to be performed at a later date?

3.0 Reading: The student needs additional instruction in reading if any of the items below are checked NO:

3.1 Yes ____ The student is able to read and understand job related materials.

No ____ Example: Is the student able to read and understand safety rules and warnings (including the shop safety test), job applications, job orders, and operating instructions for machines?

3.2 Yes ____ The student is able to follow step by step procedures listed on instructional/job sheets.

No ____

Example: Is the student able to perform tasks in a sequence after being given a demonstration and a procedure sheet to follow?

4.0 Math: The student needs additional instruction in math if any of the items below are checked NO:

4.1 Yes ____ The student is able to read a rule to increments of 1/16th inch.

No ____

4.2 Yes ____ The student is able to calculate the amount and size of material required to construct a project.

No ____

Example: Is the student able to calculate the amount and size of material required to build an engine stand?

4.3 Yes ____ The student can add and subtract fractions.

No ____ Example: Given metal to dimension, is the student able to add or subtract an amount of metal in order to achieve the correct size?

4.4 Yes ____ The student is able to read a micrometer, ruler, and vernier caliper.

No ____

4.5 Yes ____ The student is able to compute percentages and ratios.

No ____ Example: Is the student able to compute the amount of metal shrinkage, given the normal rate of shrinkage?

5.0 Visual Communication: The student needs additional instruction in visual communication if any of the items below are checked NO:

5.1 Yes ____ The student can understand working drawings and sketches.

No ____ Example: Can a student, given the necessary metal working tools and materials, construct a tool box from a drawing provided by the teacher.

IDENTIFICATION Made by: _____

BASIC SKILLS VERIFICATION FORM

Student _____ Male_____ Female____ Grade Level_____

Teacher _____ Class_____ _____ Date_____

The Basic Skills Check List (attached) for the above student indicates a need for instructional assistance in the basic skills (reading, writing, math, verbal or visual communication). The following verification and recommendations are made:

_____Lacks Reading Skills

_____Lacks Writing Skills

_____Lacks Mathematical Skills

_____Lacks Verbal Communication Skills

_____Lacks Visual Communication Skills

METHOD USED FOR VERIFICATION

Recent Test Scores:

Test	Score	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

Other Verification Methods:

_____

_____

RECOMMENDATIONS

The following instructional assistance is recommended: _____

_____.

Verification & Recommendations Made By: _____ Date:_____

Title:_____

_____

_____

FOLLOW UP

Action Taken: _____

Results: _____Qualified for advanced training

_____Qualified for employment in the trade

_____Other_____

Certified by: _____ Date:_____
Teacher

LATTICE MULTIPLICATION

(Multiplication)

Metals Math 1

LATTICE MULTIPLICATION

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

Multiplication of whole numbers

b. What student learning problem(s) prompted the development of this technique?

Students do not know how to multiply whole numbers.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Have your students fill in the attached multiplication chart. They should have their times tables memorized but if they don't they can refer to this chart while doing the lattice multiplication exercises.

b. Read to your class the example which shows how to do lattice multiplication.

c. Have your students do the problems using this method of multiplication.

3. SUGGESTED RELATED ACTIVITIES:

Give your students written multiplication problems which will enable them to practice this method of multiplication on word problems.

LATTICE MULTIPLICATION

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Fill in the "Times Table Chart". If necessary you can use this chart for reference when you do the rest of the assignment.

b. Read the worksheet "How To Do Lattice Multiplication".

c. Work the problems using this method of multiplication.

2. STUDENT ASSIGNMENT:

Your assignment starts below and continues on STUDENT PAGES 2-5.

TIMES TABLE CHART

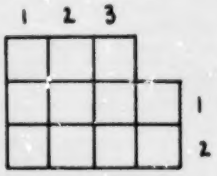
Fill in the missing numbers in each of the blank squares.

After you have filled in the chart check to see that you have the correct answers. You will find the correct answers in a math book or on a TIMES TABLE CHART like the one you find on the inside of a Peechee Folder.

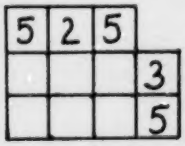
HOW TO DO LATTICE MULTIPLICATION

Step 1 Multiply 525 x 35

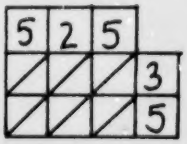
Draw 3 columns across the top and 2 columns down the side:



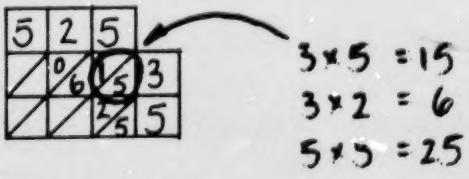
Step 2 Enter 525 across the top and 35 down the side.



Step 3 Draw diagonal lines to cut up each blank square.



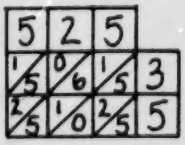
Step 4 Multiply all the numbers filling in the blank squares. Some of this is done for you.



*If the answer is only 1 digit put "0" before it to fill in both parts.

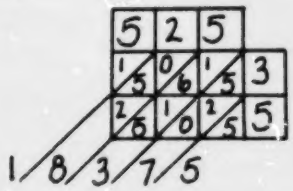
3 x 2 = 6 = 06

Step 5 Your problem should now look like this:



HOW TO DO LATTICE MULTIPLICATION

Step 6 The last step is to add the numbers on the diagonal, starting on the right.



The answer to 525 x 35 = 18,375

Do the following problem using the lattice method of multiplication. If necessary, you can look at the previous example.

MULTIPLY 53 x 21

Step 1 *hint: 2 columns across the top because it is a 2-digit number and 2 down the side because it is a 2-digit number.

Step 2 Fill in 53 x 21

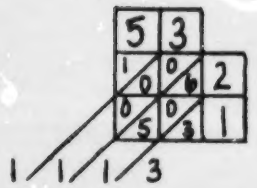
HOW TO DO LATTICE MULTIPLICATION

Step 3 Draw diagonal lines in the blank squares.

Step 4 Multiply 53 x 21

Step 5 Add the numbers on the diagonal.

Step 6 Your problem should look like this:

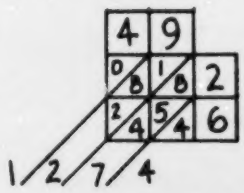


The answer to 53 x 21 = 1113

LATTICE MULTIPLICATION

Do these problems using the Lattice Method of Multiplication.

Example: 49 x 26



49 x 26 = 1274

1. 78 x 36

2. 96 x 47

3. 43 x 77

4. 64 x 36

5. 27 x 69

6. 89 x 32

7. 57 x 34

8. 83 x 24

EXTRA THINGS THAT YOU CAN DO:

Make up more problems of your own using larger numbers, example: 432 x 1976

How To Read A Ruler

(Measuring/Fractions)

Metals Math 2

HOW TO READ A RULER

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of math in the machine shop or metal shop and the use of the standard U.S. ruler. It will also acquaint the student with the use of simple fractions.

b. What student learning problem(s) prompted the development of this technique?

Many students have not had the opportunity to use the ruler and have not been exposed to measuring lengths.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Make your regular presentation on the use of the ruler.

b. Give a post-test to all students.

c. For those students who had difficulty, have the student ask one of their parents to help them complete the accompanying material.

3. SUGGESTED RELATED ACTIVITIES:

Develop other activities which involve the use of the ruler.

HOW TO READ A RULER

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Machine shop and metal shop measurements usually require the use of the ruler to determine how long, wide, or high your part or project is. The material in this packet will help you learn how to use the ruler.

b. Take home one "How To Read A Ruler" worksheet and ask one of your parents to help you learn how to use the ruler.

c. Study the material carefully and then determine the measurements on the "How To Read A Ruler" worksheet.

d. When you have completed the worksheet have one of your parents sign at the bottom of the sheet indicating that they have helped you learn the use of the ruler.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Look for various objects in your home that you can measure for additional practice. Examples: width and length of a table; the width of your TV screen.

HOW TO READ A RULER

The standard U.S. ruler is usually 12 inches long and each inch is divided into 1/16th, 1/8th, 1/4th or 1/2 inch marks. These units of measure are shown by markings, the sixteenths being the smallest, and the half-inch mark the largest. Here are some common equal measures shown in fractions:

$$\frac{2}{16} = \frac{1}{8}$$

$$\frac{4}{16} = \frac{2}{8} = \frac{1}{4}$$

$$\frac{6}{16} = \frac{3}{8}$$

$$\frac{8}{16} = \frac{4}{8} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{10}{16} = \frac{5}{8}$$

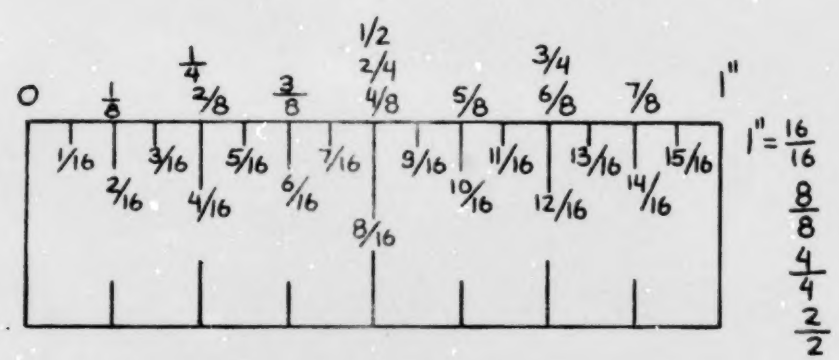
$$\frac{12}{16} = \frac{6}{8} = \frac{3}{4}$$

$$\frac{14}{16} = \frac{7}{8}$$

Note that each fraction is always divided by 2, so that the fraction is reduced to its lowest terms.

Example: $\frac{4}{8} \div \frac{2}{2} = \frac{2}{4} \div \frac{1}{2}$

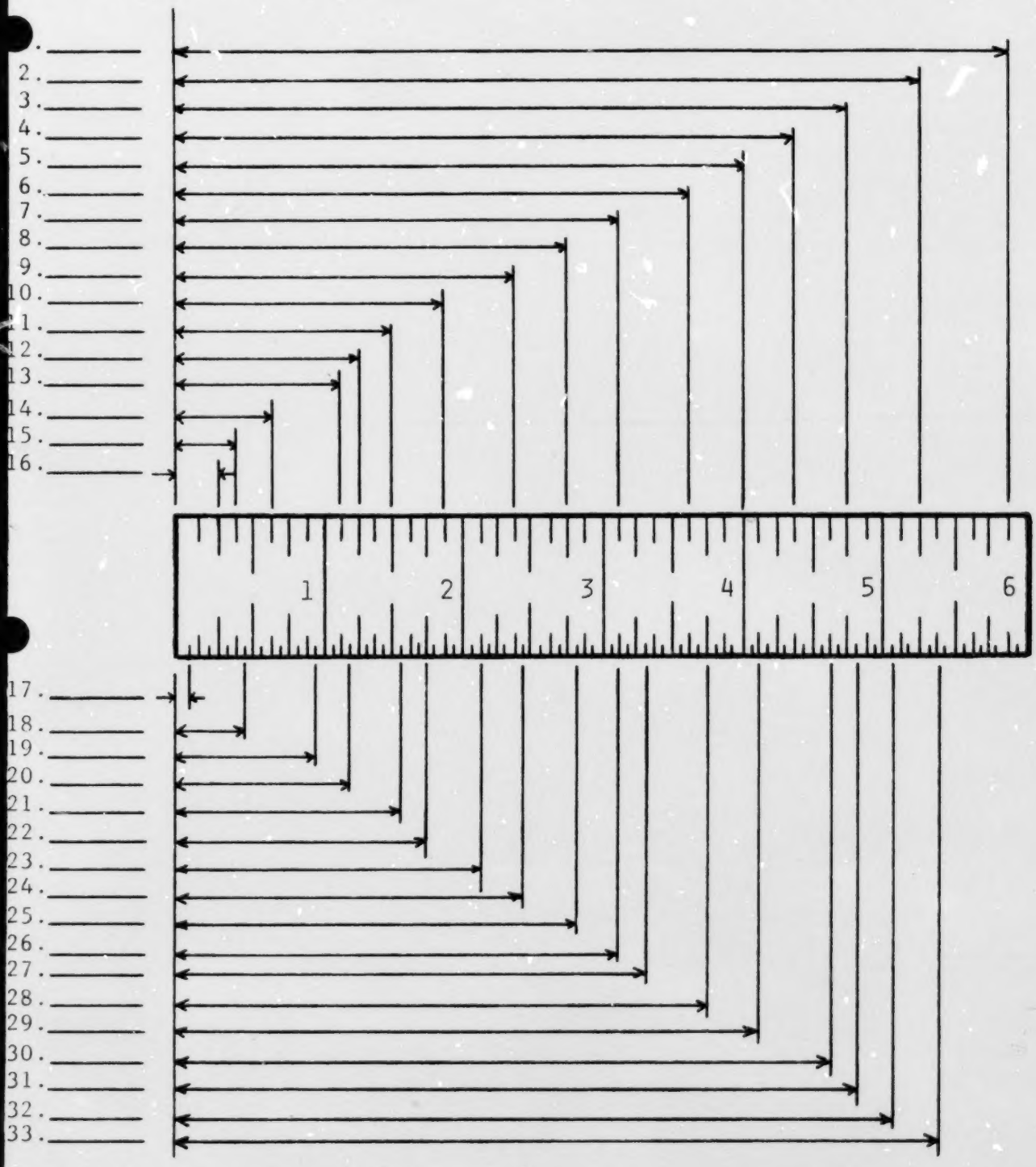
$$1" = \frac{2}{2} = \frac{4}{4} = \frac{8}{8} = \frac{16}{16}$$



STUDENT PAGE 2

HOW TO READ A RULER

Write the correct measurements on the lines provided to the left.



Parent's Signature _____ Date _____

STUDENT PAGE 3

Marking Lines For Welding

(Measuring)

Metals Math 3

MARKING LINES FOR WELDING

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of measuring in a metals class.

b. What student learning problem(s) prompted the development of this technique?

Student often are unable to draw parallel lines with even spacing.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Demonstrate on the blackboard, with a yard stick, how to draw parallel lines.

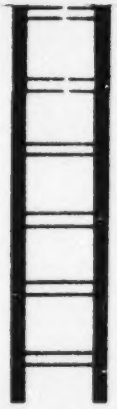
b. Demonstrate the errors made when one fails to watch the spacing all along the lines.

c. Demonstrate drawing parallel lines by using guide marks which are evenly spaced.

3. SUGGESTED RELATED ACTIVITIES:

Have your students name situations in real life where parallel lines exist, for example, railroad tracks, walls of a room, tiles on a floor, etc.

MARKING LINES FOR WELDING



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Using a blank sheet of paper, draw parallel lines about one-inch apart. Do not use a ruler or straight edge.

b. On another blank sheet of paper draw another series of parallel lines 1/2 inch apart.

c. Using another blank sheet of paper and a ruler, mark guide dots, then draw lines from dot to dot. Space the lines equally 1/2 inch apart, then 5/8 inch apart, then 3/4 inch apart, etc. without sliding the ruler along for each new measure.

d. After each drawing, hold up your sheets and look at your lines to be sure that they are parallel.

2. STUDENT ASSIGNMENT:

Your assignment is to complete 3 sets of parallel lines as described above.

3. EXTRA THINGS THAT YOU CAN DO:

a. Point out how welders mark guide lines for cutting.

b. Make a collection of pictures showing parallelism in the world.

The Correct Size Rivet

(Fractions)

Metals Math 4

THE CORRECT SIZE RIVET

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

Addition and multiplication of fractions.

b. What student learning problem(s) prompted the development of this technique?

Students lack necessary math skills for determining the correct size rivets needed for shop work.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Place the formula for figuring the rivet length on the chalkboard. Work sample problems for the class. (The formula is found on STUDENT PAGE 2 AND 3). Carefully discuss the examples on multiplying and adding fractions.

b. Pass out the information and worksheets about rivets to your students. Have them do the math problems. Go over the answers with them.

3. SUGGESTED RELATED ACTIVITIES:

Give a lesson on other types of fasteners and how their size is determined.

THE CORRECT SIZE RIVET

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Listen carefully to the class discussion about figuring correct rivet length.

b. Study The Rivet Information Sheet and work out the math problems on the worksheet.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

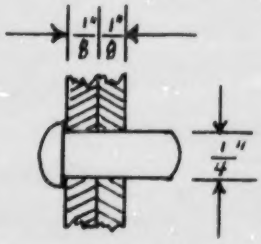
Learn about other fasteners and how their size is determined.

RIVET INFORMATION SHEET

Metal rivets should be the proper length for the material to be riveted. This is the formula to use when figuring the length of your rivet. The rivet should stick out past the material to be riveted.

Length of Rivet = $1\frac{1}{2}$ x diameter of rivet + thickness of materials to be riveted.

EXAMPLE:



FORMULA: $1\frac{1}{2} \times \frac{1}{4} + \left(\frac{1}{8} + \frac{1}{8}\right)$

STEP 1: Make $1\frac{1}{2}$ an improper fraction.

$$1\frac{1}{2} = \frac{3}{2}$$

STEP 2: Multiply $\frac{3}{2}$ x diameter of rivet.

To do this you multiply the numerators and then the denominators.

Numerator ⟶ Denominator ⟶ $\frac{3}{2} \times \frac{1}{4} = \frac{3}{8}$

STEP 3: Add the thickness of materials.

To add like fractions you add the numerators and bring down the denominators.

$$\begin{array}{r} \frac{1}{8} \\ + \frac{1}{8} \\ \hline \frac{2}{8} \end{array}$$

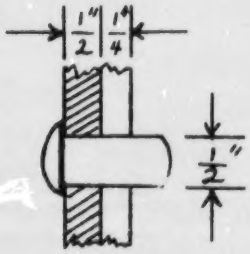
STEP 4: Add the figure from STEP 3 to the figure from STEP 2.

$$\begin{array}{r} \frac{3}{8} \\ + \frac{2}{8} \\ \hline \frac{5}{8} \end{array}$$

← This is the length of rivet you need.

THE CORRECT SIZE RIVET

INFORMATION SHEET



Here is one more example of how to find rivet lengths.

FORMULA: $1\frac{1}{2}$ x diameter of rivet + thickness of materials.

$$1\frac{1}{2} \times \frac{1}{2} + (\frac{1}{2} + \frac{1}{4})$$

STEP 1: Make $1\frac{1}{2}$ an improper fraction.

$$1\frac{1}{2} = \frac{3}{2}$$

STEP 2: Multiply $\frac{3}{2}$ x diameter of rivet.

$$\frac{3}{2} \times \frac{1}{2} = \frac{3}{4}$$

STEP 3: Add the thickness of materials. To add unlike fractions you have to find common denominators.

$$\begin{array}{r} \frac{1}{2} = \frac{2}{4} \\ + \quad \frac{1}{4} = \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$$

STEP 4: Add the figure from STEP 3 to the figure from STEP 2.

$$\begin{array}{r} \frac{3}{4} \\ + \quad \frac{3}{4} \\ \hline \frac{6}{4} \end{array}$$

Since there isn't a size 6/4" rivet this number has to be expressed as a mixed number. This is done by diving the denominator into the numerator.

$$4\overline{)\,6}\;\; 1\,\frac{2}{4}$$

$$\frac{4}{2}$$

There isn't a 1 2/4" rivet. The fraction 2/4 has to be simplified. To do this you divide the largest number you can into both the numerator and the denominator.

$$\frac{2}{4} \div \frac{2}{2} = \frac{1}{2}$$

The size rivet you need is $1\frac{1}{2}$".

THE CORRECT SIZE RIVET

WORKSHEET

Answer these questions. Look at the previous examples to figure out these problems.

Length of rivet = $1\frac{1}{2}$ x diameter of rivet + thickness of materials.

1. _____ = $\frac{3}{2} \times \frac{1}{8} + \left(\frac{1}{16} + \frac{1}{16}\right)$

2. _____ = $\frac{3}{2} \times \frac{1}{4} + \left(\frac{1}{2} + \frac{1}{2}\right)$

3. _____ = $\frac{3}{2} \times \frac{1}{4} + \left(\frac{1}{4} + \frac{3}{8}\right)$

NUMBER BINGO

(Fractions/Decimals)

Metals Math 5

NUMBER BINGO

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will help students to read common fractions and decimals correctly.

b. What student learning problem(s) prompted the development of this technique?

Students cannot read fractions or decimals.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. This exercise can be used as a warm-up activity to get your students thinking about decimals. For example, it could be used prior to a lesson on reading a micrometer.

b. This technique is a bingo game where you read off a fraction or decimal and your students have to recognize these numbers.

c. Before playing the game discuss briefly with your class 10ths, 100ths and 1000ths and decimal place values (.1, .01, .001.).

d. Explain to your students how to play bingo. Make sure when your students draw a line through the number on their cards that they do not cross out the number completely.

e. Reproduce these sample bingo cards or make your own.

f. Cut up the "numbers to be read off" for easy use in the bingo game.

g. In order to arouse student interest in the game you may want to offer a "prize".

3. SUGGESTED RELATED ACTIVITIES:

Play the game again having a student or students read the numbers. Have your students practice adding decimals they will use when reading a micrometer.

NUMBER BINGO

Numbers to be read off:

$\frac{1}{10}$	$\frac{53}{1000}$	.57	$\frac{236}{1000}$	1.589
$\frac{3}{10}$	$\frac{21}{1000}$	.095	.93	3.730
$\frac{9}{10}$	.36	.176	.234	9.806
$\frac{1}{100}$	.4	1.57	.456	.02
$\frac{35}{100}$	.7	3.79	.698	.078
$2\ \frac{129}{1000}$	.39	.863	.999	.492
.001	.050	.003	2.469	.767

SAMPLE BINGO CARD

.4	2.469	$\frac{21}{1000}$	1.589	.02
$\frac{236}{1000}$	$\frac{1}{100}$	3.730	.36	.492
.095	.999	FREE	$\frac{9}{10}$	2.469
$\frac{3}{10}$	1.57	9.806	$\frac{53}{1000}$	$2\ \frac{129}{1000}$
3.79	.767	.078	.003	.050

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SAMPLE BINGO CARDS

$\frac{1}{10}$	.02	.39	.57	$\frac{35}{100}$
$2\frac{129}{1000}$	.003	.050	.698	.078
.234	3.79	FREE	$\frac{53}{1000}$	$\frac{9}{10}$
.095	9.806	$\frac{1}{100}$	.36	3.730
1.589	.767	.492	$\frac{21}{1000}$	2.469

.698	1.589	$\frac{1}{10}$	.001	.003
.02	$\frac{35}{100}$	.57	.999	$2\frac{129}{1000}$
.7	.93	FREE	$\frac{3}{10}$	.050
$\frac{236}{1000}$	.767	.176	.456	.078
1.57	5.863	$\frac{9}{10}$	3.730	$\frac{1}{100}$

NUMBER BINGO

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You are going to be playing a bingo game. As your teacher calls off a number find it on your card and draw a line through the number as it is read.

b. Play until you fill up one row or column of numbers.

2. STUDENT ASSIGNMENT:

Your teacher will give you bingo cards and will call off the numbers for the bingo game.

3. EXTRA THINGS THAT YOU CAN DO:

Practice reading a micrometer.

Using Fractions And Decimals To Build Metal Shop Projects

(Converting Fractions To Decimals)

Metals Math 6

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USING FRACTIONS AND DECIMALS TO BUILD METAL SHOP PROJECTS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the math skill of converting fractions to decimals.

b. What student learning problem(s) prompted the development of this technique?

Many students have forgotten this skill from lack of use or have not been taught this method of finding decimals.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Present a lesson on the conversion of fractions to decimals. Remind students how to round off numbers.

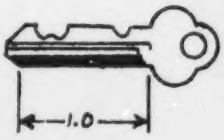
b. Have your students study the accompanying material and work the problems.

c. Check answers and review any problems that are incorrect.

3. SUGGESTED RELATED ACTIVITIES:

Give your students a list of decimals to convert to fractions.

USING FRACTIONS AND DECIMALS TO BUILD METAL SHOP PROJECTS



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. The materials in this packet will help you convert fractions to decimals.

b. Read and study the materials on STUDENT PAGE 2.

c. Work all problems found on STUDENT PAGE 3.

d. Have your teacher correct your answers.

e. Review your problems to see where you made mistakes.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Practice this skill with different fractions and let your teacher check your work.

USING FRACTIONS AND DECIMALS TO BUILD METAL SHOP PROJECTS

The changing of fractions to decimals is very important especially when working in the machine shop. Many times a size is given in fractions, but it will help to be able to measure in decimals.

Let's start by using the fraction of $\frac{1}{8}$. Remember that the top number of a fraction is called the numerator and the bottom number of a fraction is called the denominator. To find the decimal equivalent, you divide the numerator by the denominator or if you forget the names of the numbers, divide the bottom number into the top number.

$$\frac{1}{8} = 8\overline{)\,1}$$

You now notice 8 does not divide easily into 1, so you add a decimal point to the right of the one and add three (3) zeros.

$$8\overline{)\,1.000}$$

Remember to move the decimal point up for your answer.

$$8\overline{)\,1.000}$$

Now you are ready to divide.

$$\begin{array}{r} .125 \\ 8\overline{)\,1.000} \\ \underline{8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \end{array}$$

You read your answer as one hundred twenty-five thousandths.

USING FRACTIONS AND DECIMALS TO BUILD METAL SHOP PROJECTS

Find the decimal equivalents for the following fractions. (Write your answers so that they have three decimal places.)

1.) $\frac{1}{4}$ =

2.) $\frac{3}{8}$ =

3.) $\frac{7}{8}$ =

4.) $\frac{3}{4}$ =

5.) $\frac{1}{2}$ =

6.) $\frac{5}{8}$ =

7.) $\frac{3}{32}$ =

8.) $\frac{5}{16}$ =

9.) $\frac{3}{16}$ =

10.) $\frac{7}{32}$ =

11.) $\frac{9}{16}$ =

12.) $\frac{7}{16}$ =

MEASURING WITH DECIMALS

(Decimals)

Metals Math 7

MEASURING WITH DECIMALS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the math skill of ADDING and SUBTRACTING DECIMALS in the machine shop and metal shop.

b. What student learning problem(s) prompted the development of this technique?

Many students have difficulty adding and subtracting decimals because they forget to line up decimal points.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Present your regular lesson on the addition and subtraction of decimals.

b. Give a post test on adding and subtracting decimals to all students.

c. Have those students who had difficulty study the accompanying material and work the problems on STUDENT PAGE 3.

d. Check the answers and review any problems that are incorrect.

3. SUGGESTED RELATED ACTIVITIES:

Continually review the addition and subtraction of decimals.

MEASURING WITH DECIMALS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Read and study the material in this packet.

b. Work all the problems.

c. Have the teacher correct your answers.

d. Review your problems to see where you made mistakes.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

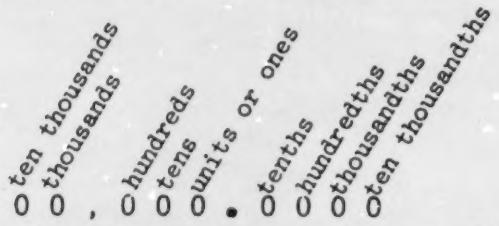
Use a Sears or Penny's catalog and add the prices of different items for extra practice.

ADDITION AND SUBTRACTION OF DECIMALS

STUDY SHEET

The addition and subtraction of decimals is very important in the machine/metals shop. You must be able to perform these operations in order to machine your project or the parts you are making so they are the exact size.

The first step in learning decimals is to know what each place is named before and after the decimal point.



EXAMPLE:

.125 ------- There are three numbers to the right of the decimal point, therefore you would read this number as one hundred twenty-five thousandths.

Next, the number: .062. Again there are three places behind the decimal point. This would be read as sixty-two thousandths.

****

When adding numbers with decimal points, always remember to place decimal points vertically.

EXAMPLE:

Add 5.125, .005, 24, 61.5

1. Write numbers in a column so that the decimal points are all in line.

2. If a number shows no decimal point, one can be placed after the last number. Thus "24" can be written "24." in this example. Also, after a decimal point, zeros can be used to fill decimal places following the last number. Thus 61.5 can be written 61.500. In both cases the decimal point in 24 and the extra zeros in 61.5 do not change the value of the numbers.

```
 5.125
  .005
24.
61.5
------
90.630
```

```
 5.125
  .005
24.000
61.500
------
90.630
```

ADDITION AND SUBTRACTION OF DECIMALS

Add the following:

1.) 3.7, .025, 25, 4.5, 100.1

2.) 52.625, .005, 72, 98.6

3.) 9.62, 586, .52, .3, 4.010

Remember when adding decimals that the decimal point in your answer is in line with the decimal points in the numbers that you added.

When subtracting decimals, the same procedure is followed as in adding decimals. Remember to keep decimal points in line. Add zeros when needed.

EXAMPLE:

34 - 5.625

$$\begin{array}{r} 34.000 \\ -\ 5.625 \\ \hline 28.375 \end{array}$$

Subtract the following:

1.) $\begin{array}{r} 54.2 \\ -\ 32.654 \\ \hline \end{array}$

2.) $\begin{array}{r} 98.34 \\ -\ 6.967 \\ \hline \end{array}$

3.) $\begin{array}{r} 34. \\ -\ 27.48 \\ \hline \end{array}$

4.) $\begin{array}{r} 101.5 \\ -\ 87.505 \\ \hline \end{array}$

5.) $\begin{array}{r} 39. \\ -\ 7.06 \\ \hline \end{array}$

6.) $\begin{array}{r} 84.6 \\ -\ 3.726 \\ \hline \end{array}$

STUDENT PAGE 3

READING A MICROMETER

(Decimals)

Metals Math 8

READING A MICROMETER

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of math, especially the addition of decimals. It will teach the student how to read the micrometer when measuring diameters and flat stock.

b. What student learning problem(s) prompted the development of this technique?

Many students cannot grasp the addition of decimals when it is shown on the micrometer.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Present your regular lesson on the use of the micrometer.

b. For students who have difficulty reading the micrometer, have them take the accompanying material home and ask one of their parents to help them learn to read the micrometer.

c. Have one of their parents sign the last page to indicate they have helped their son or daughter with this assignment.

3. SUGGESTED RELATED ACTIVITIES:

Continually review the use of the micrometer and have students practice its use.

READING A MICROMETER

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. The information in this packet will help you learn how to read a micrometer.

b. Take the attached materials home and ask one of your parents to help you learn how to use the micrometer.

c. Study the material carefully along with the examples and then determine what the measurements are on the worksheet.

d. When you have completed the worksheet, have one of your parents sign at the bottom of the sheet indicating that they have helped you learn how to use the micrometer.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2-4.

3. EXTRA THINGS THAT YOU CAN DO:

Measure various pieces of round stock that your instructor will give you for extra practice.

READING A MICROMETER

In order to reinforce the teacher instructions, we would like for you to take a few minutes to review the use of a micrometer with your son or daughter.

The micrometer is a tool used to measure the diameter or thickness of an object. Micrometers vary in size from a one inch (1") micrometer up to a micrometer so large that you cannot use it without help. Micrometers are named according to the limit of what they can measure. For example:

A micrometer that measures from:

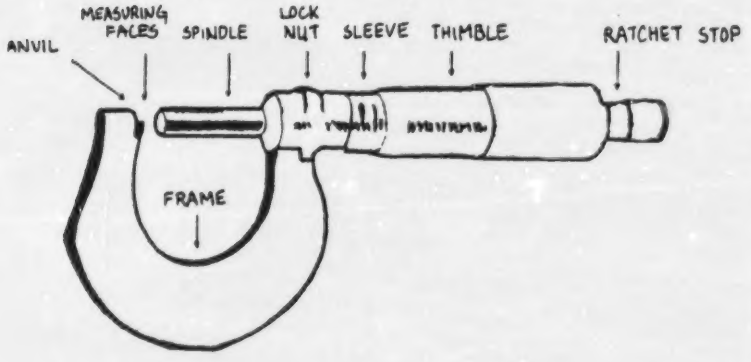
0" to 1" is called a one-inch micrometer.

1" to 2" is called a two-inch micrometer.

2" to 3" is called a three-inch micrometer.

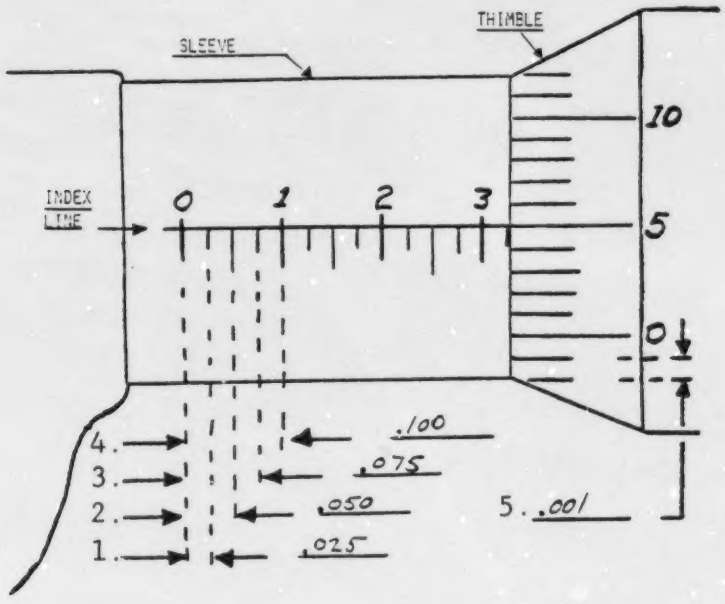
All micrometers read the same regardless of what size micrometer you are using.

Each part of the micrometer has a name. The micrometer below has all of its parts labeled:



READING A MICROMETER

This is an enlarged view of the micrometer sleeve and thimble.



Note that each line on the sleeve measures .025, read as twenty-five thousandths (No. 1). Each numbered line on the sleeve measures .100, read as one hundred thousandths (No. 4). Each division on the thimble measures .001, read as one thousandths (No. 5).

DIRECTIONS:

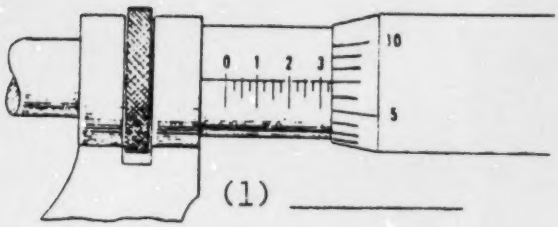
To determine a reading on the micrometer, look at the last numbered line showing on the sleeve. On the illustration above it is the number 3, so you have .300. Now look to see how many .025 lines are showing on the sleeve between the number 3 and the end of the thimble. In this case there is one .025 line showing. You now have .325. Look on the thimble and you notice the number 5 is lined up with the index line. You now add .005 to .325 which gives you a reading on the micrometer of .330 (read as three hundred and thirty thousandths).

Now work out the reading on the micrometers shown on STUDENT PAGE 4.

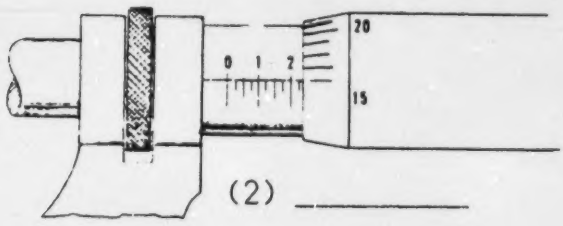
READING A MICROMETER

WORKSHEET

Find the readings shown below.



(1) _____



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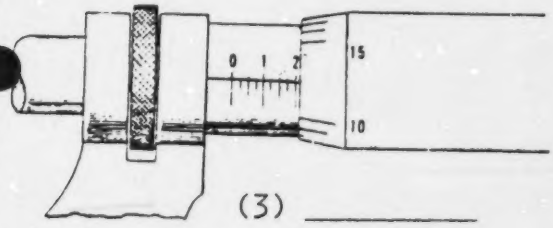
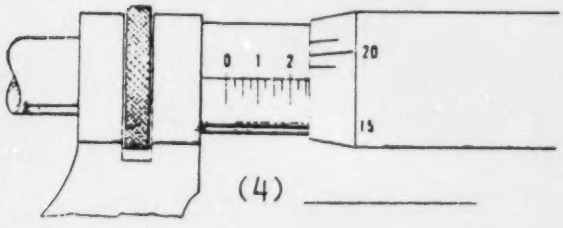
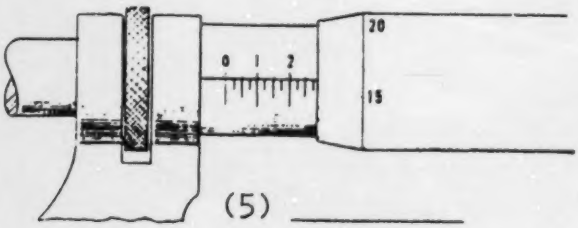


(3) _____



(4) _____



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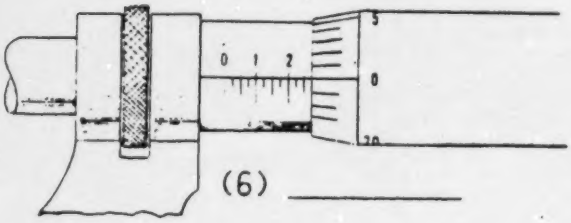

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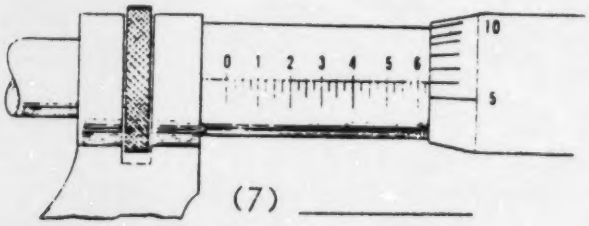

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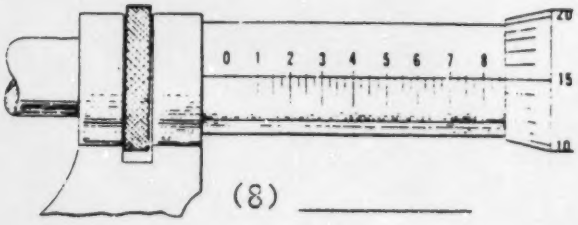

(8) _____

Parent's signature: _____

Date: _____

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VOICE (VOCATIONAL OCCUPATIONAL INFORMATION CENTER FOR EDUCATORS)
721 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

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"LEARNING TO READ AND WRITE THE DRAFTING WAY"
"LEARNING TO DO MATH THE DRAFTING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE DRAFTING WAY"